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ABSTRACT

Adolescent Portuguese-English bilingual students participated in a study that examined the relationship between reading rate and reading comprehension. The 31 subjects were placed in one of three groups: (1) normal readers, reading at grade level as indicated by IQ test scores; (2) slow readers, reading at least two years below expected grade level; and (3) retarded students who were reading at grade level. Each subject read narrative passages that had been written at the third and fourth grade reading levels. Half of the passages had been transliterated to a Portuguese orthography that produced the English sounds of the passage. The findings indicated that reading rate and comprehension are independent of each other. The three groups did not demonstrate a precise correlation of comprehension and rate, since the slow readers showed high comprehension while reading at a slow rate (this occurred regardless of the orthography of the passage). In addition, analyses of covariance showed that IQ predicted comprehension in a parallel way for individuals and groups, while rate did not do so. (FL)

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THE RELATIONSHIP OF COMPREHENSION AND ORAL READING SPEED IN NORMAL, SLOW, AND RETARDED READERS

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ABSTRACT

The relation of reading speed and reading comprehension was investigated. Thirty-one adolescent Portuguese-English bilinguals read narrative passages at third grade and fourth grade reading levels. Half the passages were transliterated to a Portuguese orthography that produced the English sounds of the passage. The children comprised three groups: a) normal readers, reading at grade level expected from an IQ score, b) slow readers, at least two years below expected grade level, and c) children who met requirements for classification as retarded reading at grade level. Speed in reading passages and comprehension by a Cloze test were found to be only slightly related, while comprehension was predicted by IQ scores. Speed was predicted by teacher ratings of reading level. Differences between the English and Portuguese orthography passages were found and discussed.

THE RELATIONSHIP OF COMPREHENSION AND ORAL
READING SPEED IN NORMAL, SLOW, AND
RETARDED READERS

This research investigates the relation of speed and comprehension in reading. Perfetti and Hogaboam (1975) have made a strong case that reading comprehension and reading speed are closely linked. They selected good and poor readers in third and fifth grades by a standardized group test. Since many children finish before time limits, speed is not usually seen to be a factor in pupils' performance on such tests. Perfetti and Hogaboam then found that the good and poor readers differed greatly on speed of decoding single words. This points to an important, and perhaps primary, correlation between speed and comprehension in reading. Indeed, Perfetti and Lesgold (1979) have used this sort of data to propose the slower speed of decoding in poor readers takes up more primary memory (the "bottleneck" hypothesis) and leaves fewer resources for comprehension.

A variety of other analyses, however, suggests that speed (decoding) and comprehension should be somewhat independent. First, Craik and Lockhart (1972) have suggested (and have been supported in many experiments) that rehearsal (a task much like oral reading) can lead to either an acoustic memory or a more semantic memory. In a similar type of experiment, Elias and Perfetti (1973) showed that semantic associations caused false recognition of semantic distractors, while rhymes caused false recognition of auditory distractors, indicating that the semantic and acoustic aspects of remembering can be separated.

Similarly, Golinkoff and Rosinsky (1976) used picture-word interference tasks to demonstrate that the impaired decoding skills of poor readers did not affect the acquisition of word meaning from words in isolation. Here, too, the correlation of word reading and comprehension breaks down. McCormick and Samuels (1979) also found the relationship of speed and comprehension less important than the relation of accuracy and comprehension in first and second graders. Most recently, Roberts and Smith (1980) have demonstrated, with poor readers, that methods to improve reading speed altered speed strongly, but affected comprehension slightly. However, their method to improve comprehension increased both rate and comprehension.

The present study seeks to further investigate the correlation between oral reading speed and comprehension. In this study, parallel texts, in English and transliterated to Portuguese orthography were read by adolescents who were Portuguese-English bilinguals. The adolescents comprised three groups: a) children of normal intelligence and reading scores; b) children of normal but with demonstrated difficulties in reading, and c) children who had levels of intelligence like those classified as retarded, but no apparent difficulty in reading.

METHOD

Subjects

The subjects were 31 Portuguese-English bilingual adolescents from several schools in Newark, New Jersey. The subjects' ages ranged from 14-5 to 18-10 and all were enrolled in regular programs of the Newark Board of Education. Each child and each minor child's parents completed consent forms for testing and finding data from school records.

Pretesting and Group Definitions

The CTBS Total Reading score and the Slosson Intelligence Test (SIT) scores were used to choose subjects in three groups. First a reading expectancy was calculated from the SIT mental age by the Harris (1975) Reading Expectancy (RE) formula,

$$RE = MA - 5.0$$

The normal readers (N = 10) were all pupils who had IQs in the normal range (above 76 on the SIT according to New Jersey Special Education regulations) and whose reading score was no more than two years below his RE. Their GEs ranged from 4.4 to 13.6.

The disabled readers (N = 10) had IQs in the normal range and reading scores at least two years below their RE. Their GEs ranged from 4.2 to 7.6.

The retarded children (N = 11) had IQs that would place them in the category of Educably Mentally Retarded according to New Jersey Special Education regulations (1½ to 3 standard deviations below the mean) according to the SIT. Their GEs ranged from 3.1 to 5.5.

Reading Passages

The passages were from a variety of publishers and had been selected on grade level (3rd or 4th grade by Spache formula) and content (narrative) for an oral reading project of the Reading Disability Research Institute of the Rutgers Medical School (Goldsmith & Haupt, Note 1). Each passage used here was the first 100 words plus text to complete a sentence of the original passage.

Two passages, one third and one fourth grade, were transliterated to a Portuguese orthography prepared by the second author and checked with a teacher of ESL to Portuguese background children (Note 2). An example of the English original and its Portuguese transliteration is shown below:

(English) Here is money to get your hair cut.

(Portuguese) Ere es mani tu guete iour ere cate.

The letter correspondences used to create the transliteration are shown in Appendix I.

Fifteen-item comprehension tests were prepared using a modified Cloze technique in which only substantive words (nouns, main verbs, adjectives, and adverbs) were deleted.

Two practice passages were prepared using the Portuguese orthography. The paragraphs were 40-50 words long and were taken from the third grade passages of the Specific Skills series (Barnell-Loft, 197).

Procedure

Each subject was brought individually to a room provided by the school attended by that subject. They were told that they would read passages aloud and that after each one, they would answer questions spoken by the examiner. They were told to read as quickly as possible and that their reading was being recorded.

Each subject practiced reading the Portuguese orthograpy in the practice passages until each practice passage was read with no errors. Then, for each passage, the pupil was given a single-page sheet with the passage on it. The child read the passage into a cassette recorder. When the oral reading was finished, the examiner read the text for the Cloze passage and wrote down the child's answers. The passages were presented in a partially counter-balanced order based on a Latin square.

RESULTS

Order of Presentation

Both comprehension and time-to-read scores were analyzed to determine if there were any effects of the order of presentation of the passages. The time to complete the first passage appeared longer, but neither variable showed a significant effect of order.

Relation of Rate and Comprehension

Rate of reading was calculated by dividing 60 times the number of words in the passage by the time to read in seconds. The time to read was measured by the stopwatch from listening to the oral reading on a cassette tape. Comprehension was found by scoring each Cloze answer as literally correct or not and dividing the number of correct answers by 15 to get a proportion correct. The reliability of the comprehension scores ranged from .636 to .826 with a median of .804. The rates were also highly consistent: the correlation of rates from the two English passages was .874 ($p < .0001$) and .855 ($p < .0001$) for the two Portuguese passages.

The reading level of the passages (third or fourth grade) and the orthography (English or Portuguese) formed a 2 x 2 factorial design within each subject. To facilitate further analyses, variables for the average score for all passages read, a contrast of grade levels, a contrast of orthographies, and an interaction contrast for grade and orthography were calculated. These scores were used in a repeated measures analysis of variance design as described by Bock (1975). The analysis of the comprehension and rate scores is shown in the left-hand columns of Table 1.

Insert Table 1 about here

Table 1

F-tests for constructed variables to test hypotheses about grade, orthography, and grade-by-orthography interactions for comprehension and rate scores and for covariance analyses using IQ and rate as covariates

Hypothesis	Cloze	Rate	Cloze/rate	Cloze/IQ
Group (Gp)	20.06 ****	17.05 ****	11.47 ***	1.38
Orthography (Or)	3.00	2.38	2.28	1.80
Grade (Gr)	25.53 ****	71.72 ****	16.29 ****	11.45 ***
Gp x Or	.59	2.88	.15	.65
Gp x Gr	.49	.15	1.05	.46
Or x Gr	10.85 ***	.00	17.74 ****	3.40
Gp x Or x Gr	.13	.95	2.09	.00

**** $p < .0001$

*** $p < .001$

** $p < .01$

* $p < .05$

Significance Tests

The F-ratios for the group, grade and the interaction of orthography x grade were all significant at the .001 level or less for the comprehension score. Only the F-ratios for group and grade were significant for reading rate. The significance patterns are different and even where the same test produces significance, as in the F-test for grade, the value of the F-ratio for the rate is far higher than that for comprehension. There was a significant F-ratio for orthography x grade for comprehension (the third grade English orthography got higher comprehension scores than the fourth grade English orthography but there was no such difference for Portuguese orthography), but there was no such effect for rate. Thus, the pattern of significance tests is markedly different for the two variables, comprehension and rate.

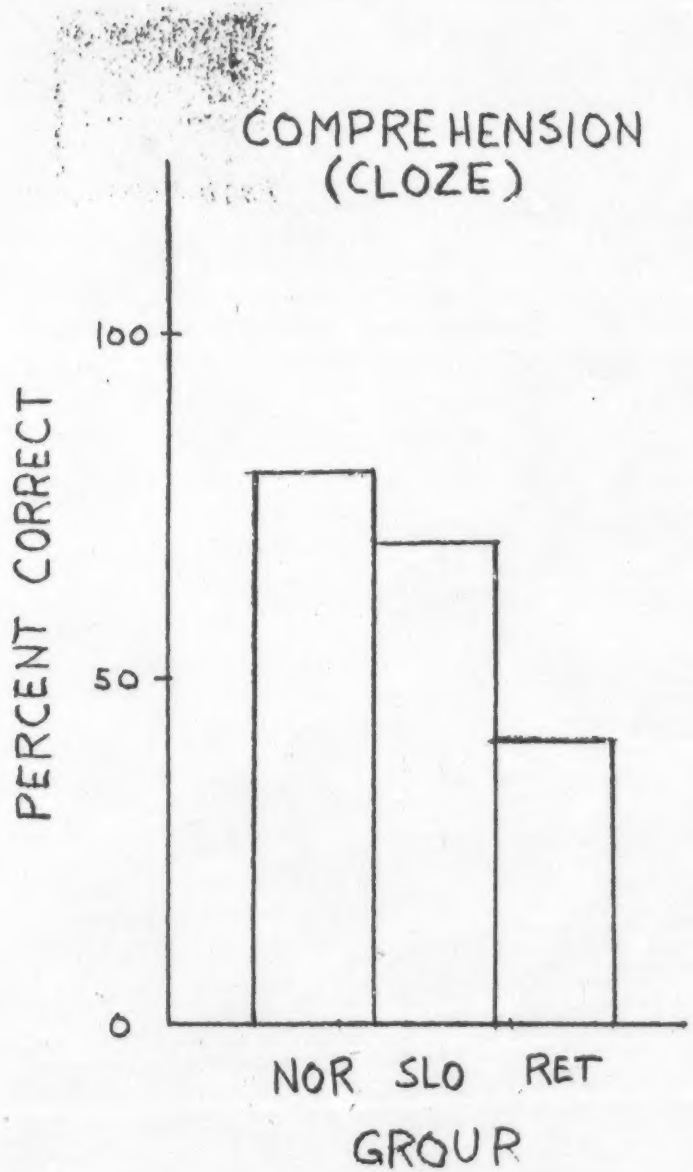
Comparison of Groups

The comparison of the groups on the two variables provides another way of differentiating comprehension and rate. Figure 1 shows that the Cloze task produced differences between the retarded children and the other two groups, while the reading rate produced differences between the normal readers and the other two groups. For both of these comparisons, Tukey(a) test was significant at $p < .01$.

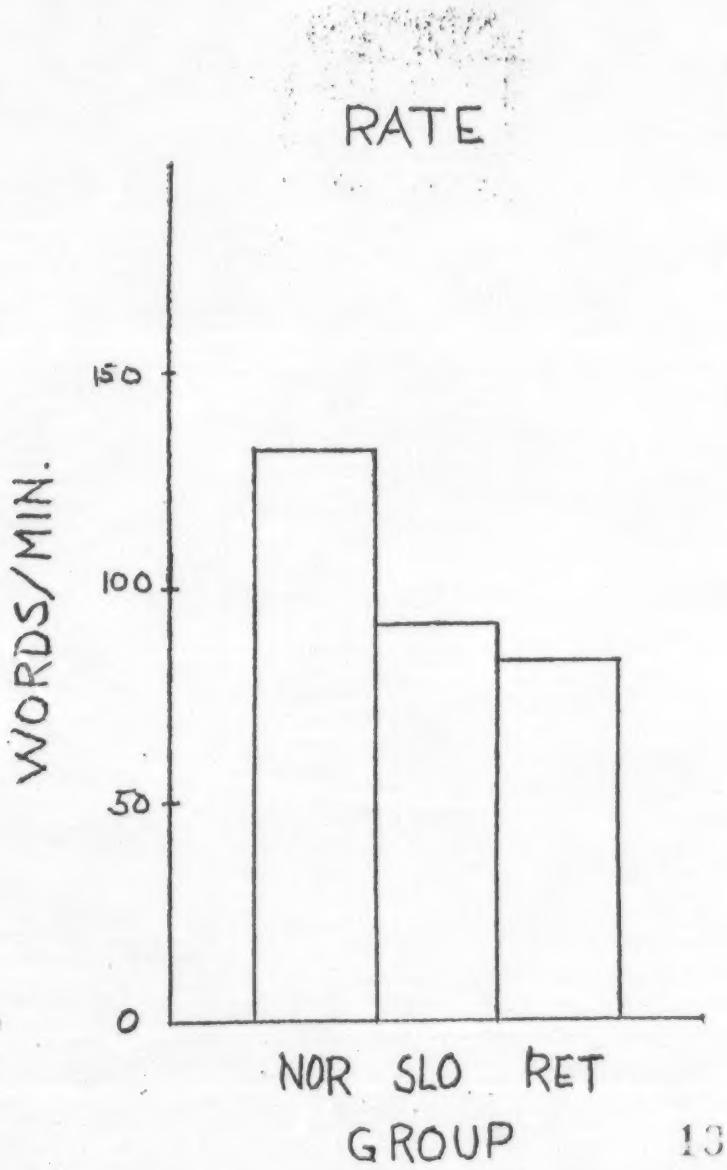
Insert Figure 1 about here

Prediction of Comprehension and Rate

Table 2 shows the prediction of comprehension and rate using a stepwise multiple-regression program of SAS (SAS, 1979). The predictors were the IQ from the SIT, the grade level from the CTBS test, a teacher estimate of reading GE, sex, the CA of the child, the MA from the SIT, and IQ score calculated as


COMPREHENSION
(CLOZE)
PERCENT CORRECT
100
50
0
NOR SLO RET
GROUP

12


RATE
WORDS/MIN.
150
100
50
0
NOR SLO RET
GROUP

13

MA ÷ CA. It is clear that the calculated IQ score or MA was the best predictor of comprehension scores and the teacher estimate of reading GE was the best predictor of rate. This latter prediction held true even when children, such as the normals in this study, do almost no reading in class. Thus, rate and comprehension do not share common predictors.

Insert Table 2 about here

In addition, several other patterns of correlation appear. The comprehension scores are better predicted for Portuguese-orthography passages than English. These are small differences, however.

The opposite effect is found for rate. When the passage was in English, the rate was highly predictable from the teacher rating of grade level. These same ratings predict speed, but at a far lower level when the passage was in Portuguese orthography. Thus, a shift from a traditional orthography to a novel one retained the predictability of comprehension, while there was a sharp decline in the predictability of rate. Comprehension and rate thus show very different patterns of predictor variables and are divergent as major aspects of the reading process.

Analyses of Covariance

Two analyses of covariance, shown in the third and fourth columns of Table 1, were also performed. First, an analysis of comprehension scores using rate as a covariate was done. This analysis, in the third column, attempts to use rate as an explanatory variable for the comprehension scores. The significance table was left substantially unchanged and so rate cannot be considered a satisfactory explanatory variable for comprehension in a correlational sense.

Table 2

Stepwise multiple regression predictors found in the order selected for English and Portuguese passages. The predictors are shown for comprehension and reading rate with the multiple R^2 for the predictors below them. A significance level of .10 was used to retain predictors

Variable	English		Portuguese	
	Third	Fourth	Third	Fourth
Comprehension (Cloze)	SITC + CTBS	MA	SITC	SITC
	(.327)	(.567)	(.526)	(.593)
Rate	Teacher GE	Teacher GE + Sex + CA	Teacher GE	Teacher GE
	(.661)	(.717)	(.203)	(.177)

Next, based on the frequency of effects of IQ and MA as predictors in multiple regression, the calculated IQ score was used as a covariate to explain the comprehension effects. When IQ was used as a covariate, only the effect for grade level remained significant. Thus, the comparison of groups disappears when relative level of verbal ability is used as an explanatory variable.

The dropoff in comprehension from the third to fourth grade passages was large and approximately equal for all groups of subjects. In addition, eliminating the correlation of this difference score with the calculated IQ left this pattern unchanged: the differences due to passage grade level were approximately the same after removal of any components predictable from IQ.

DISCUSSION

The present study has demonstrated in several ways that reading rate and comprehension are independent. First, the groups do not demonstrate the usual precise correlation of comprehension and rate, with the slow readers showing high comprehension while reading at a slow rate. This effect occurred regardless of the orthography of the passage. In addition, analyses of covariance showed the IQ (as a measure of general cognitive level or a measure of listening comprehension) predicted comprehension in a parallel way for individuals and groups, while rate was not able to do so. This is similar to Sticht's (1979) results. Thus rate fails in several ways to be an important correlation of reading comprehension. These results are also consistent with recent research (Fleisher, Jenkins, & Pany, 1980) in which training in speed of single-word and phrase reading speed had minimal effects on comprehension.

Overall, there were differences in reading speed on the two orthographies. However, these differences were predicted by the overall reading rate and thus did not enter into the analysis. The disruption of reading speed engendered by the use of a strange orthography did not disrupt the comprehension of the passages. On the other hand, an increased regularity in orthography (provided by the Portuguese orthography) did not produce higher reading speeds in the slow readers, as some previous research has indicated for ita with dyslexic children (Downing, 1965).

It is important to remember that these reading tasks were easy in terms of the standards of most of these children, with the exception of the retarded children for whom the passages matched their reading grade levels. Therefore, we cannot know what differences might have been found for the normal and slow

readers if harder tasks had been found for them. In addition, the Cloze test used for comprehension does not permit the analysis of subscores for different comprehension tasks and thus reveal how the normal and slow readers differed on different aspects of comprehension.

The exact Cloze scores for the Normal and Slow reader groups were far above the level of .53 suggested by Anderson (1971) for independent reading. For the retarded children, the Cloze scores were in the instructional range, thus suggesting that the reading passages were well matched to the pupils' abilities. Indeed, the third grade passages had Cloze scores above the instructional level, while the fourth grade passages had Cloze scores below the instructional level.

A final question remains about the relation of IQ scores and CTBS scores to reading comprehension. The IQ score was more closely related to the measure of reading comprehension than the more specific measure, the CTBS. There are two possible reasons for this result. First, the SIT, and individually administered procedure is more reliable. Second, the SIT and the Cloze score were both administered orally, providing a similarity of presentation which was not present for the Cloze and the CTBS scores.

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Appendix I

Transliteration of Sounds

English Sounds	English Orthography	* Portuguese Orthography
a	act, bat	écte, béte
ā	able, cape	êiboule, queipe
ā (r)	air, dare	êre, dêre
a (r, l)	art, calm	ârt, calm
b	back, rub	béque, rabe
ch	chief, beach	chife, bitche
d	do, bed	du, béde
e	ebb, set	ébe, séte
e	equal, bee	iquol, bi
f	fit, puff	fête, pafe
g	give, beg	gueve, begue
h	hit, hear	ête, ieur
i	if, big	êfe, bêque
i	ice, bite	aice, baite
j	just, edge	jaste, édge
k	kept, make	quépte, meique
l	low, all	lòu, ól
m	my, him	mai, eme
n	now, on	nau, one
ng	sing, England	singue, Inglande
o	box, hot	baquese, áte
o	over, no	ouvor, nòu

o (r, l)	order, ball	order, ból
oi	oil, joy	oil, joi
oo	book, put	bouque, poute
oo	ooze, rule	uze, ròule
p	page, stop	paige, stape
r	read, cry	ride, crai
s	see, miss	si, mêsse
sh	shoe, push	chu, pouche
t	ten, bit	téne, bete
th	thin, path	dene, pede
th	that, other	déte, ador
u	up, love	ape, lave
u	use, cute	iuse, quiute
u	urge, burn	arge, barne
v	voice, live	voice, lêve
w	west, away	ueste, auei
y	yes, young	iesse, iangue
z	zeal, lazy, those	zil, leizi, douze
zh	vision, measure	vijon, mejur
/ə/	a in alone	aloune
	e in system	sêsteme
	i in easily	izêli
	o in gallop	guélape
	u in circus	sòrcase

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* Portuguese Orthography (Duarte, I. Personal Communication, 1980)